

APPENDIX D HERBICIDE ENVIRONMENTAL CHARACTERISTICS AND TOXICITY

Herbicide	Characteristics		
	Mechanisms of degradation	Half-life in soil	Mobility in Soil
Triclopyr	Degradation mainly by soil microbes	14 days	Moderate to high ($K_{oc} = 59$ [SERA 2011 p. 206])
Aminopyralid	Degradation by soil microbes and sunlight	130 days (lab study); 25-38 days in field studies	High (K_{oc} range = 1-27 [SERA 2007, p. 129])
Imazapic	Degradation primarily due to soil microbes	113 days (lab study); 31-410 days (field study)	Moderate (K_{oc} range = 7-267 [SERA 2004, p. tables-1])
Metsulfuron methyl	Degraded by soil microbes and chemical hydrolysis	120 days	Moderate to high (K_{oc} range = 4-206 [SERA 2004, p. tables-1, tables-5])

Herbicide	Solubility	Aquatic Half-life	Aquatic Toxicity and Bioconcentration
Triclopyr	Salt formulation is water-soluble.	Salt formulation can degrade in sunlight with a half-life of 1-8 days [SERA 2011 p. 204].	Acid and salt formulation is slightly toxic to fish and aquatic invertebrates. Triclopyr acid has relatively low potential for bioconcentration (SERA 2011, p. 62).
Aminopyralid	Soluble in water	About half a day – degraded by sunlight (SERA 2007)	Aminopyralid is practically non toxic to fish and aquatic invertebrates (USEPA 2005). Not expected to bioconcentrate in fish.
Imazapic	Soluble in water	30 days – degraded by sunlight	Low toxicity to fish (SERA 2004, p. 4-4). Very low level of bioconcentration in fish tissue (SERA, p. 3-17).
Metsulfuron methyl	Soluble in water	53-279 days (DuPont 2007)	Low toxicity to fish and aquatic invertebrates, (SERA 2004, p. 4-5 to 4-6). Studies suggest low potential for bioconcentration (SERA 2004, p. 3-19).

Table D-3. Herbicide Toxicity Information For Mammals									
<i>Herbicide</i> (Technical product unless specific formulation noted)	<i>Acute Toxicity</i>						<i>Chronic Toxicity</i>		
	<i>Oral LD₅₀ (rat)</i>	<i>Dermal LD₅₀ (rabbit)</i>	<i>4-Hour Inhalation LC₅₀ (rat)</i>	<i>Skin Irritation (rabbit)</i>	<i>Skin Sensitization (guinea pig)</i>	<i>Eye Irritation (rabbit)</i>	<i>24-Month Dietary NOEL (mouse)</i>	<i>24-Month Dietary NOEL (rat)</i>	<i>12-Month Dietary NOEL (dog)</i>
	<i>mg/kg BW</i>		<i>mg/L</i>				<i>mg/kg BW/day</i>		
Triclopyr									
Renovate	2574(M) 1847(F)	>5000	>2.6	May cause	May cause	Severe	NA	12	0.5
Garlon 3A	2574(M) 1847(F)	>5000	>2.6	May cause	May cause	Severe	↑Chronic toxicity data available ↑ only for technical triclopyr acid		
Aminopyralid									
Aminopyralid acid	5000	>5000	>5.5	No	No	Moderate-Severe	50 (NOAEL)	250 (NOAEL)	93 (NOAEL)
Milestone	5000	>5000	>5.79	Slight	No	Slight	↑Chronic toxicity data available ↑ only for technical aminopyralid acid		
Imazapic									
Imazapic	>5000	>5000	>4.83	None	No	Slight	>1288	>1133	150 (LOAEL)
Metsulfuron methyl									
Metsulfuron methyl	>5000	>2000	>5	Slight	None	Moderate	5000 ppm (18mo)	500ppm	500 ppm
Data from: Triclopyr – SERA 2011, Appendices 4, 5, & chapters 3.1.4, 3.1.5, 3.1.11-3.1.13; Aminopyralid – SERA 2007, Appendix 3-1 & USEPA 2005; Imazapic – SERA 2004, Appendix 1, & chapters 3.1.4, 3.1.5, 3.1.11-3.1.13; Metsulfuron methyl - SERA 2004, Appendix 1, & Chapters 3.1.4, 3.1.5, 3.1.11-3.1.13. NA = Not Available									

Herbicide Formulation (Technical product unless specific formulation noted)	Avian Receptors				Terrestrial Invertebrates		Aquatic Receptors		
	Bobwhite Quail		Mallard Duck		Earth-worm	Honeybee	Daphnia	Bluegill	Rainbow Trout
	Oral LD ₅₀ mg/kg BW	8-day dietary LC ₅₀ ppm (in food)	Oral LD ₅₀ mg/kg BW	8-day dietary LC ₅₀ ppm (in food)	LC ₅₀ ppm (in soil)	Topical LD ₅₀ ug/bee	48-hour LC ₅₀ Mg/L (in water)	96-hour LC ₅₀ Mg/L (in water)	96-hour LC ₅₀ Mg/L (in water)
Triclopyr									
Triclopyr acid		2934	1698	5620	1110	>100	357-837	155	79
Triclopyr triethylamine salt		11,622	2055	>10000	146	>100	357-837	65-233	274-286
Aminopyralid									
Aminopyralid acid	>2250	>5556 mg/kg diet		>5496 mg/kg diet	>5000 mg/kg soil	>100	>98.6	>100	>100
Imazapic									
Imazapic	>2150	>5000	>2150	>5000		>100	100	>100	>100
Metsulfuron methyl									
Metsulfuron methyl	>5620ppm	>5620	>5620ppm	>5620	>1000 mg/kg soil	>25	>150	>150	>150

LD₅₀ - Lethal Dose 50; LC₅₀ - Lethal Concentration 50. From: Triclopyr – SERA 2011, Appendices 2, 3, 5, 7; Aminopyralid – USEPA 2005; Imazapic - SERA 2004, Appendices 2, 3; Metsulfuron methyl - SERA 2004, Appendices 2, 3, 5, 6; DuPont 2007 (for toxicity to earthworm).

REFERENCES

- DuPont. 2007. DuPont Escort XP technical bulletin. Available online (accessed 4/6/12):
http://www2.dupont.com/Land_Management/en_US/assets/downloads/pdfs/General/K-14796.pdf
- SERA. 2004. Metsulfuron methyl human health and ecological risk assessment – final report. Available online at:
<http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>. 152 pp.
- SERA. 2004. Imazapic human health and ecological risk assessment – final report. Available online at:
<http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>. 110 pp.

SERA. 2007. Aminopyralid human health and ecological risk assessment – final report. Available online at: <http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>. 231 pp.

SERA. 2011. Triclopyr human health and ecological risk assessment – final report. Available online at: <http://www.fs.fed.us/foresthealth/pesticide/risk.shtml>. 267 pp.

US Environmental Protection Agency. 2005. Pesticide fact sheet: aminopyralid. 56 pp. Available online at: <http://www.epa.gov/opprd001/factsheets/aminopyralid.pdf>